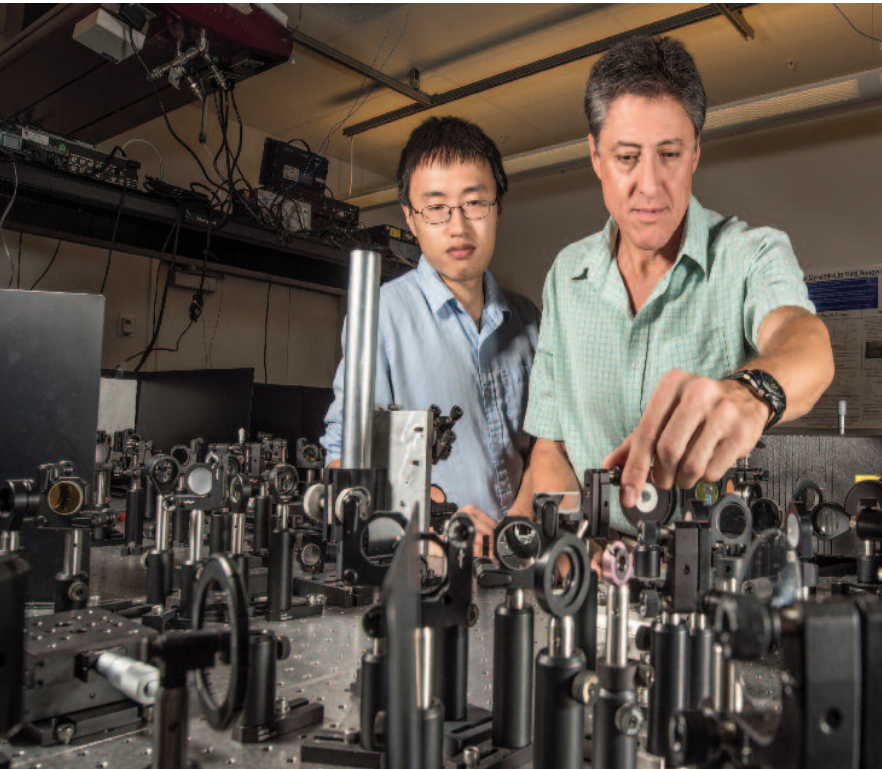




Meet Steve Girrens
Life lessons from the farm: responsibility, shared fate, effectiveness..... 12

A light touch means faster electronics



Nanotechnology experts at Sandia create first terahertz-speed polarization optical switch
By Sue Major Holmes

A Sandia-led team has for the first time used optics rather than electronics to switch a nanometer-thick thin film device from completely dark to completely transparent, or light, at a speed of trillionths of a second.

The team led by principal investigator Igal Brener (5265) published a *Nature Photonics* paper this spring with collaborators at North Carolina State University. The paper describes work on optical information processing, such as switching or light polarization control using light as the control beam, at terahertz speeds, a rate much faster than what is achievable today by electronic means, and a smaller overall device size than other all-optical switching technologies.

Electrons spinning around inside devices like those used in telecommunications equipment have a speed limit due to slow charging rate and poor heat dissipation, so if significantly faster operation is the goal, electrons might have to give way to photons.

(Continued on page 4)

USING OPTICS — Former Sandia researcher Yuanmu Yang, left, and Sandia’s Igal Brener set up to do testing in an optical lab. The pair were part of a team that, for the first time, used optics rather than electronics to switch a nanometer-thick thin film device from completely dark to completely transparent in trillionths of a second.

(Photo by Randy Montoya)

Sandia wins 5 regional tech transfer awards

By Manette Fischer



Sandia has won five awards from the Federal Laboratory Consortium for its work to develop and commercialize innovative technologies.

The annual FLC awards program recognizes federal laboratories and their industry partners for outstanding technology transfer achievements.

The consortium’s Mid-Continent and Far West regions recognized Sandia’s:

- **3-D printing** for subscale wind turbine blades, which speeds up production for wind blade prototypes, lowering the cost of wind energy;
- **Neuromorphic Cyber Microscope**, which mimics the brain’s ability to process large amounts of data to protect computer systems from cyberattacks;
- **SmartLAMP**, a small diagnostic device that detects Zika and other diseases rapidly and accurately;
- **Advanced Nanomaterials Development**, used for energy conservation and temperature regulation; and
- **SpinDx** and **Trak Male Fertility Testing System**, which are lab-on-a-disk diagnostic devices. The latter can be used to test male fertility at home.

Sandia partnered with Oak Ridge National Laboratory and won a Regional Partnership Award for production of subscale 3-D printed wind turbine blades. Together, the labs are working to shorten the production cycle of new blades and reduce costs. Trying out new wind turbine blade designs is currently expensive due to the multimillion-dollar cost of making complex wind turbine molds. Sandia designed the subscale blade to replicate the wake of a full-scale blade. It was one-

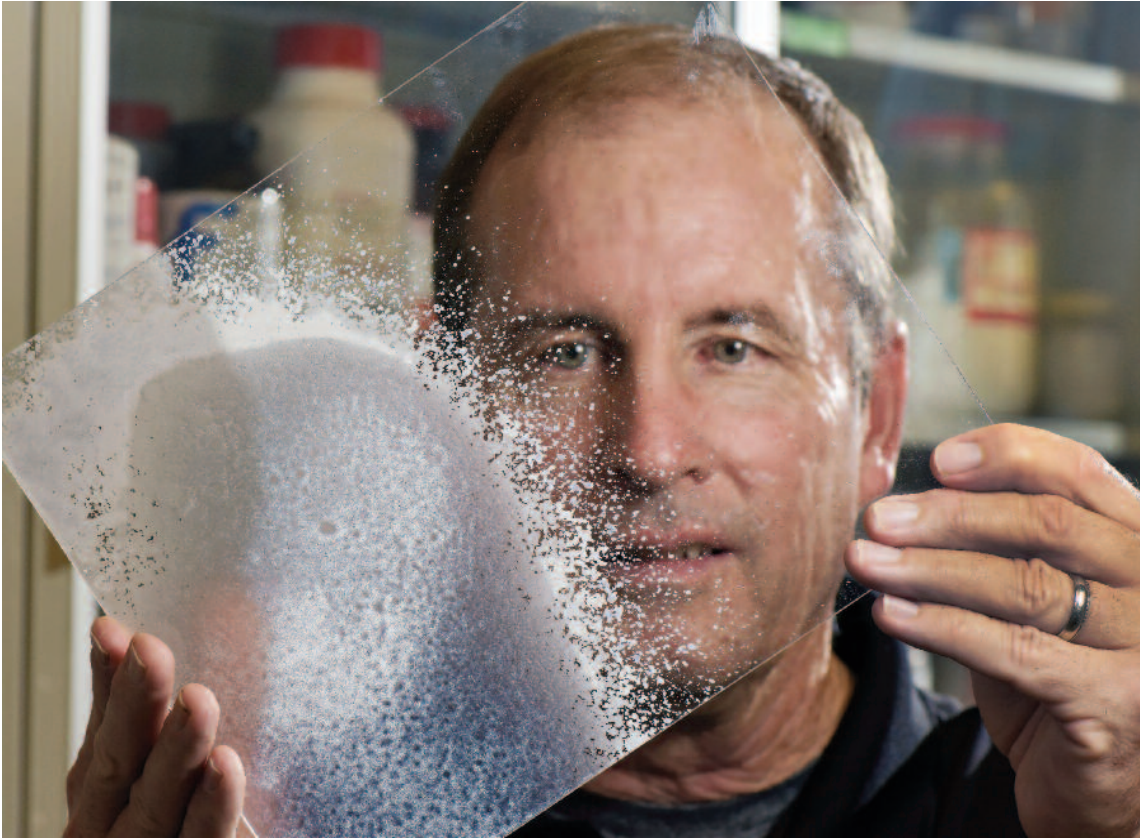
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WHAT WE SAW AT THE ECLIPSE



Sandians share their stories, photos about August 21 total eclipse Pages 6-7

Cleaning up subways



SANDIA ENGINEER Mark Tucker holds a sample of decontamination foam modified to stick to the walls and ceilings of subway tunnels. Mark has spent much of the past 20 years thinking about ways to clean up chemical or biological warfare agents.

(Photo by Randy Montoya)

Sandia’s 20-year mission to stop anthrax in its tracks

By Mollie Rappe

If you’re like most people, you don’t spend much time thinking about what would happen if anthrax was released into your local subway system.

Luckily, Sandia engineer Mark Tucker (6633) has spent much of the past 20 years thinking about incidents involving chemical or biological warfare agents, and the best ways to clean them up. Mark’s current project focuses on cleaning up a subway system after the

release of a biological warfare agent such as anthrax.

In addition to developing Sandia’s decontamination foam, which was used to decontaminate parts of federal office buildings and mailrooms during the 2001 anthrax letter attacks, Mark led Sandia’s team during numerous chemical and biological remediation projects sponsored by the Department of Homeland Security Science and Technology Directorate’s Homeland Security Advanced Research Projects Agency.

(Continued on page 5)

Inside ...

| | |
|--|---|
| Sandia’s first machine learning conference | 4 |
| Sandia opens office in ABQ innovation district | 8 |
| Ideas abound for 2017 Pollution Prevention Week .. | 8 |
| Mission Innovators honored | 9 |



Shay Williams, Sandia intern and rodeo queen..... 9



Low temperature combustion chemistry 3

That’s that

Over the past few weeks, nature has been on full display in all its cosmic wonder and, yes, all of its cosmic indifference – I’m thinking here of the total eclipse that was visible over a large swath of the US, the wildfires ravaging the West, and hurricanes Harvey and Irma slamming into the continent and leaving devastation, loss, and heartache in their wakes.

The eclipse, the hurricanes, the fires: They remind us that there are forces beyond our control, some that fill us with wonder and others that, while they fill us with dread, galvanize us for action.

But if these powerful forces, tangible expressions of the laws of physics, tell us something about nature, they tell us, too, about ourselves.

Think of it: On August 21 across the nation, there was a brief period where all our differences were set aside and everyone was caught up in a shared experience. Presidents and plumbers, professors and police officers, doctors and farmers, bankers and bakers, celebrities and average Janes and Joes – for the duration of the eclipse it didn’t matter what your politics were, how you voted, what language you spoke, who you loved or worshipped, or any of the other things to too often divide us. For that short span, we were all fellow travelers through the solar system, experiencing a shared sense of transcendence. I think we need that, that experience of seeing ourselves as part of something bigger than ourselves. We may have different names for it, we may not even recognize it in ourselves, but it’s there – a desire, even a longing, to feel a sense of connectedness to each other and to the infinite.

One might say I’m putting fancy words to it, reading too much into it, that an eclipse, after all, is just an eclipse. I get that. But really, didn’t you feel it, perhaps just for one brief shining moment, that sense that you were privileged to have a consciousness and a place in the universe where you could experience such a wonder? I did.

On the subject of the eclipse, you’ll want to check out our spread on pages 6 and 7. Two of our fellow Sandians, Peter Schmidt and Dan Riley, were among many of our colleagues who travelled to different spots across the country to see the eclipse in its totality. Peter and Dan shared their experiences with us in two riveting personal accounts of their experiences, along with some remarkable photos they got along the way. Check it out.

* * *

While the eclipse may have connected us on a cosmic plane, the recent onslaught of hurricanes brought us together on a much more urgent and practical level.

As terrible and deadly these storms were, things could have been far worse, the loss of life far more devastating. Thanks to the efforts of scientists and engineers and technicians and the visionary policymakers who funded their weather satellite work beginning in the 1950s, we were able to see these storms coming, giving us a chance to prepare and get out of harm’s way.

Knowing where the storms were headed made a huge difference, but even with that advance knowledge we couldn’t do anything about the meteorological forces that stopped Harvey in its tracks right over Houston, resulting in rainfall the likes of which it would be an understatement to call “torrential.” We couldn’t do anything to calm the furies of Irma; all we could do was board up our houses and businesses and make a run for it. But at least our technology gave us a bit of a headstart and for that we are grateful

A lot has been written about the everyday heroes in Houston who risked their own lives time and again to rescue people stranded in rising floodwaters. The so-called Cajun Navy – folks in bass boats, jon boats, airboats – was on the spot, answering the call for help, even getting there before they were asked. And they weren’t the only ones to step up. People across Houston and environs were there for each other. Politics, religion, gender, race – none of those were factors in the grass-roots relief efforts. The only question that mattered was “Do you need help?”

The people of Houston, faced with one of the worst natural disasters this country has ever seen, epitomized the maxim that “In a crisis like this, we are all first responders.” And reminded us that when the chips are down, we can and will count on each other.

See you next time.

– Bill Murphy (MS 1468, 505-845-0845, wtmurph@sandia.gov)

Labs wins 5 FLC awards



SANDIA CHEMICAL ENGINEER Aashish Priye (8621) and former Sandia Labs virologist Sara Bird offer a view into the SmartLAMP prototype, with biomedical engineer Cameron Ball (8621) in the background. Sandia has received a Notable Technology Development Award from the Federal Laboratory Consortium for SmartLAMP, a smartphone-controlled, battery-operated point-of-care diagnostic device. (Photo by Randy Wong)

(Continued from page 1)

third the size and cost 5 percent of the standard full-scale blades. Using 3-D printing, the mold-building process is less labor-intensive as well.

Winners of Notable Technology Development Awards

The Neuromorphic Cyber Microscope and Smart-LAMP won Notable Technology Development Awards.

The Neuromorphic Cyber Microscope, developed by Sandia with industry partner Lewis Rhodes Labs, mimics the brain’s ability to process large amounts of data as a way to thwart cyberattacks with great speed and accuracy. Easily integrated into an existing security infrastructure, the Cyber Microscope increases the speed and accuracy of anomaly detection while using less power. It’s more than 100 times faster and 1,000 times more energy-efficient than racks of conventional cybersecurity systems.

SmartLAMP is a smartphone-controlled, battery-operated point-of-care diagnostic device that weighs less than a pound, costs as little as \$100, and can detect Zika and other vector-borne diseases rapidly and accurately. Current testing for these viruses requires a laboratory equipped with expensive instruments that can cost up to \$20,000, and patients can wait days for results. SmartLAMP is easy to use, easy to store, and can be used by almost anyone in modern and developing countries and locations where stable electricity is unavailable.

Advanced Nanomaterials Development by Sandia and IR Dynamics won an Excellence in Technology Transfer Award. The team has been working on thermochromic materials for smart regulation of solar heat by developing nanoparticles that have tunable optical properties triggered by the environment. These nanomaterials transition to let heat through when it’s cold outside and reflect heat when it’s warm. The materials will be incorporated into a variety of products where controlling solar heat gain and infrared reflectivity is a significant advantage.

SpinDx creators come up with spin-off

SpinDx and the Trak Male Fertility Testing System won an Outstanding Commercialization Success Award. Trak is based on Sandia’s SpinDx portable lab-on-a-disk diagnostic technology, which Sandia originally developed to help detect biological and chemical threats. When the inventors realized there could be multiple commercial applications for the technology, they founded Sandstone Diagnostics and licensed the patented SpinDx technology from Sandia.

After researching male infertility, they recognized men were underserved in fertility testing and that a simple device for home use could be created. Sandstone’s patent-pending product, the Trak Male Fertility Testing System, has received clearance from the Food and Drug Administration. Sandstone also is developing the technology for other medical uses that have the potential to save lives.

“These FLC awards highlight the breadth of Sandia technologies that are being developed and transferred to the private sector,” says Jackie Kerby Moore, Sandia’s manager of Technology and Economic Development and the Labs’ representative to the FLC. “Combined, Sandia and our partners are benefiting Sandia’s missions in defense and energy and strengthening the US economy in cyber, solar, wind, and medical markets.”

The FLC Awards are ranked as some of the most prestigious honors in tech transfer. Sandia winners were recognized at an awards ceremony Aug. 30 in Pasadena, California.



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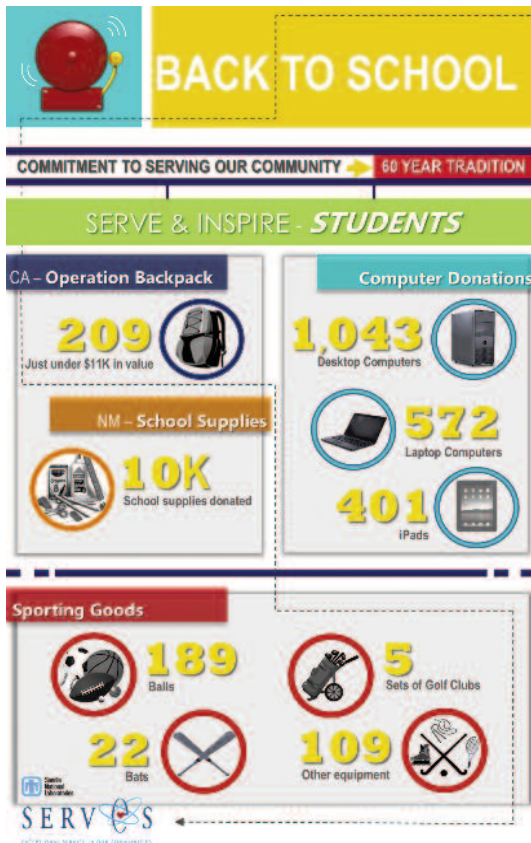
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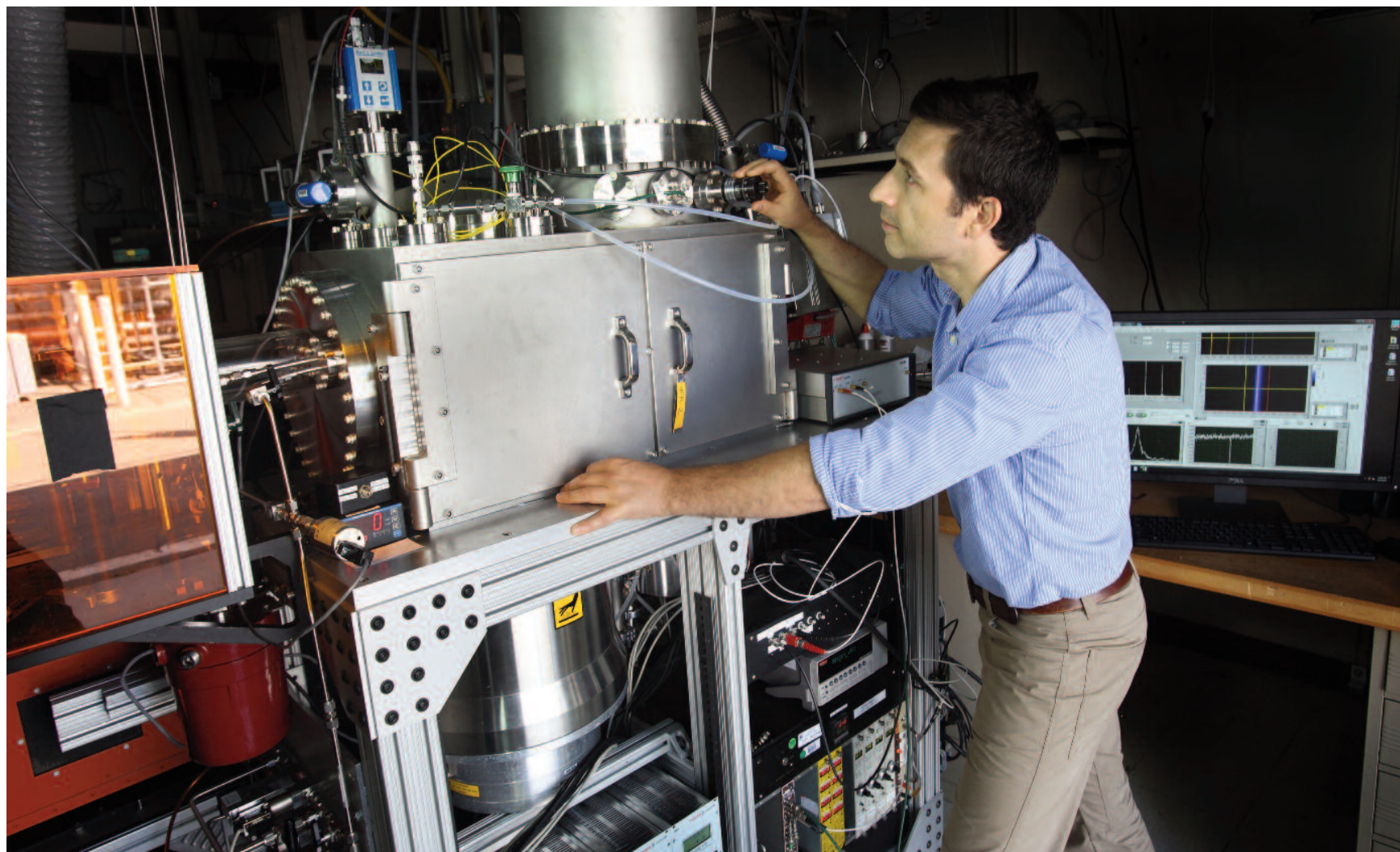
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Understanding chemistry in low-temp combustion promises more efficient engine designs

Sandia team produces fundamental chemical knowledge that will aid in predicting oxidation chemistry



LOW-TEMP COMBUSTION — Leonid Sheps adjusts equipment in a Combustion Research Facility lab. Leonid helped develop some of today's cutting-edge experimental methods, used to unravel the complexity of hydrocarbon oxidation. (Photo by Dino Vournas)

By Michael Padilla

Hydrocarbons come in all shapes and sizes in nature, and their oxidation reactions can be quite complex. A fundamental understanding of this important area of chemistry requires careful and often very challenging experiments, along with state-of-the-art theoretical calculations.

A team of researchers at Sandia's Combustion Research Facility were up to that challenge, pushing the limits of what's possible with experiments and theory to unravel the complexity of hydrocarbon oxidation.

By conducting experiments in engine-relevant conditions using novel equipment and methods, the team produced new fundamental chemical knowledge. This new knowledge will aid in modeling the combustion of traditional fuels and proposed new fuels, facilitating the development of future efficient engines. Detailed fuel chemistry can be used to optimize performance in emerging engine designs.

According to principal investigator Leonid Sheps (8353), this approach is most fruitful in low-temperature combustion, below about 1,000 K, where oxidation chemistry dominates fuel reactivity.

"In this 'autoignition' regime, fuels with different molecular structure can react to form different products and at vastly different rates," he says. "This is one promising strategy for engine optimization. In contrast, in the high-temperature regime the

kind of chemical reactions that dominate combustion are much less sensitive to the exact identity of the fuel."

The underlying goal of the work is to understand how the molecular structure of hydrocarbons affects their oxidation chemistry in general, and to develop ways of modeling the combustion of other fuel candidates with predictive accuracy.

Leonid worked with former Sandia postdoctoral researcher Ivan Antonov, who served as the lead author, in publishing a paper titled, "Pressure-Dependent Competition among Reaction Pathways from First- and Second-O₂ Additions in the Low-Temperature Oxidation of Tetrahydrofuran," in *The Journal of Physical Chemistry A*. Coauthors included Judit Zádor, David Osborn, Craig A. Taatjes (all 8353) and former Sandia postdoctoral researchers Brandon Rotavera and Ewa Papajak.

This study targeted the autoignition of tetrahydrofuran (THF), a prototypical 5-membered ring cyclic ether, allowing the team to study the effects of cyclic structure (which include a certain degree of rigidity, as well as ring strain) and an ether functional group (O atom in the ring) on the autoignition mechanism.

The team conducted the research at elevated temperatures and pressures — approaching engine-relevant conditions to better understand the autoignition chemistry of ethers in important environments.

"Experiments at high pressures are extremely challenging," Leonid says. "There is a lack of experimental data and conclusions extrapolated from low-pressure work are often unreliable. We are producing critically important knowledge that cannot be obtained in other ways."

In principle, autoignition can occur through myriad coupled chemical reactions, many of which have complex temperature- and pressure-dependence. This study revealed the autoignition mechanism of THF by narrowing down all such possible processes to about a dozen or so key reactions that dominate THF oxidation. The work showed how the molecular structure of THF was responsible for selecting these key reactions. Such mechanistic insights increase the overall understanding of oxidation chemistry and allow researchers to make predictions about other fuel compounds.

High-pressure experimental reactor created to achieve desired sample conditions

The researchers relied on several innovations in their experimental approach, from the chemical reactor created for the research to the detection and analysis method. "Our Sandia-developed experimental capabilities are unique in the world," Leonid says.

The team used a high-pressure flow reactor, capable of maintaining precisely controlled experimental conditions, free from effects of turbulence or wall reactions. They coupled this

reactor to a newly developed novel mass spectrometer with a 100-fold increase in sensitivity over traditional approaches. This high sensitivity is needed in high-pressure experiments to detect elusive, fleeting chemical intermediates that are present at vanishingly small concentrations but have an outsized influence on the chemistry in question.

The work was conducted by flowing a mixture of reactants (THF, oxygen and a small quantity of Cl₂ — a photolytic radical source) in an inert buffer gas through the chemical reactor at strategically chosen temperatures, pressures, and mixture compositions. Short laser pulses were used to rapidly create Cl radicals within this mixture, which rapidly abstracted H atoms from THF.

This process resulted in a nascent population of hydrocarbon radicals, thus mimicking the initial stages of THF combustion.

The THF-yl radicals then reacted with O₂ and underwent a series of chemical reactions that collectively make up THF oxidation. Throughout the reactions, the team continuously monitored the chemical composition of the reacting mixture by photoionization mass spectrometry.

"This technique provided the time histories of nearly all important chemical species at once with microsecond time resolution," Leonid says. "This helped provide an in-depth look at the chemistry 'as it happens' as opposed to collecting final products for later analysis, which would leave much to guesswork as to how exactly these products formed."

The team also used isotopically labeled reactants, in which some of the H atoms in THF were replaced by D atoms, which are chemically similar but have a different mass. By analyzing the mass of the reaction products and radical intermediates, the team was able to identify which H or D atom moved during various reaction steps and thus track which way several key chemical species were formed.

The team continues to investigate the oxidation chemistry of diverse hydrocarbon compounds with a focus on the effects of molecular structure including size, degree of branching, and various functional groups. Further work includes expanding the range of chemical systems to alkanes, alkenes, ketones, other ethers, and esters to fully understand the link between molecular structure and reactivity.

The work, sponsored by the Basic Energy Sciences division of the Office of Science, DOE, is part of a joint effort between Sandia and Argonne national labs and benefits from close collaboration with other experimentalists and theoreticians, both at Sandia and Argonne.



Plasmonics

(Continued from page 1)

To use photons effectively, the technique requires a device that goes from completely light to completely dark at terahertz speeds. In the past, researchers couldn't get the necessary contrast change from an optical switch at the speed needed in a small device. Previous attempts were more like dimming a light than turning it off, or required light to travel a long distance.

The recent breakthrough shows it's possible to do high contrast all-optical switching in a very thin device, in which light intensity or polarization is switched optically, says the paper's lead author, Yuanmu Yang, a former Sandia postdoctoral employee who worked at the Center for Integrated Nanotechnologies, a DOE user facility jointly operated by Sandia and Los Alamos national laboratories. The work was done at CINT.

"Instead of switching a current on and off, the goal would be to switch light on and off at rates much faster than what is achievable today," Yuanmu says.

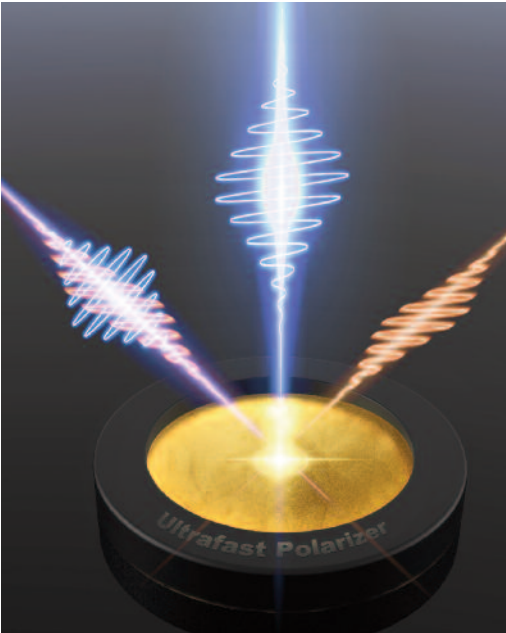
Processing speed important in communications, physics research

A very rapid and compact switching platform opens up a new way to investigate fundamental physics problems. "A lot of physical processes actually occur at a very fast speed, at a rate of a few terahertz," Yuanmu says. "Having this tool lets us study the dynamics of physical processes like molecular rotation and magnetic spin. It's important for research and for moving knowledge further along."

It also could act as a rapid polarization switch — polarization changes the characteristics of light — that could be used in biological imaging or chemical spectroscopy, Igal says. "Sometimes you do measurements that require changing the polarization of light at a very fast rate. Our device can work like that too. It's either an absolute switch that turns on and off or a polarization switch that just switches the polarization of light."

Ultrafast information processing "matters in computing, telecommunications, signal processing, image processing, and in chemistry and biology experiments where you want very fast switching," Igal says. "There are some laser-based imaging techniques that will benefit from having fast switching too."

The team's discovery arose from research funded by the Energy Department's Basic Energy Sciences, Division of Materials Sciences and Engineering, that, among other things, lets Sandia study light-matter interaction and different concepts in nanophotonics.



A PLASMONIC PERFECT ABSORBER made from indium-doped cadmium oxide switches the polarization state of infrared light in less than a picosecond.

"This is an example where it just grew organically from fundamental research into something that has an amazing performance," Igal says. "Also, we were lucky that we had a collaboration with North Carolina State University. They had the material and we realized that we could use it for this purpose. It wasn't driven by an applied project; it was the other way around."

The collaboration was funded by Sandia's Laboratory Directed Research and Development program. Team members include Igal, Salvatore Campione, and Mike Sinclair.

Using laser beams to carry information, switch device

The technique uses two laser beams, one carrying the information and the second switching the device on and off.

The switching beam uses photons to heat up electrons inside semiconductors to temperatures of a few thousand degrees Fahrenheit, which doesn't cause the sample to get that hot but dramatically changes the material's optical properties. The material also relaxes at terahertz speeds, in a few hundred femtoseconds or in less than one trillionth of a second. "So we can switch this material on and off at a rate of a few trillion times per second," Yuanmu says.

Sandia researchers turn the optical switch on and off by creating something called a plasmonic cavity, which confines light within a few tens of nanometers, and significantly boosts light-matter interaction. By using a special plasmonic material, doped cadmium oxide from North Carolina State, they built a high-quality plasmonic cavity. Heating up electrons in the doped cadmium oxide drastically modifies the opto-electrical properties of the plasmonics cavity, modulating the intensity of the reflected light.

Traditional plasmonic materials like gold or silver are barely sensitive to the optical control beam. Shining a beam onto them doesn't change their properties from light to dark or vice versa. The optical control beam, however, alters the doped cadmium oxide cavity very rapidly, controlling its optical properties like an on-off switch.

The next step is figuring out how to use electrical pulses rather than optical pulses to activate the switch, since an all-optical approach still requires large equipment, Igal says. He estimates the work could take three to five years.

"For practical purposes, you need to miniaturize and do this electrically," he says.

The paper's authors are Yuanmu, Igal, Salvatore Campione, Willie Luk, and Mike Sinclair at Sandia and Jon-Paul Maria, Kyle Kelley, and Edward Sachet at North Carolina State.

From games and speech recognition to ensuring global peace

Sandia's first machine learning and deep learning conference

By Mollie Rappe

Last year, a computer program beat a professional Go player for the first time. Go is even more difficult for computers than games such as chess. The program was trained by playing two computerized Go systems against each other, using deep learning, a kind of machine learning. Each system combined two artificial neural networks, one to learn the next best move and another to predict the winner of the game. Of course, machine learning and deep learning algorithms can be applied to significant real world challenges, including the Labs' specialty in national security.

Deep learning uses multiple layers of artificial neural networks to learn complex patterns in data, such as recognizing and classifying images and recognizing and parsing language. The term "deep" comes from having multiple layers of biologically inspired networks, which

was extremely taxing until recently, says Tim Draelos (6362), an artificial neural network expert and co-founder of Sandia's Machine Learning and Deep Learning Conference along with Danny Dunlavy (1461), a machine learning expert.

Systems Mission Engineering Center 6300 and the Data Science Research Challenge sponsored the two-day conference held this August. The goal was to bring together researchers, practitioners, and interns from across the Labs working in the areas of machine learning and deep learning. Presenters came from 13 Centers

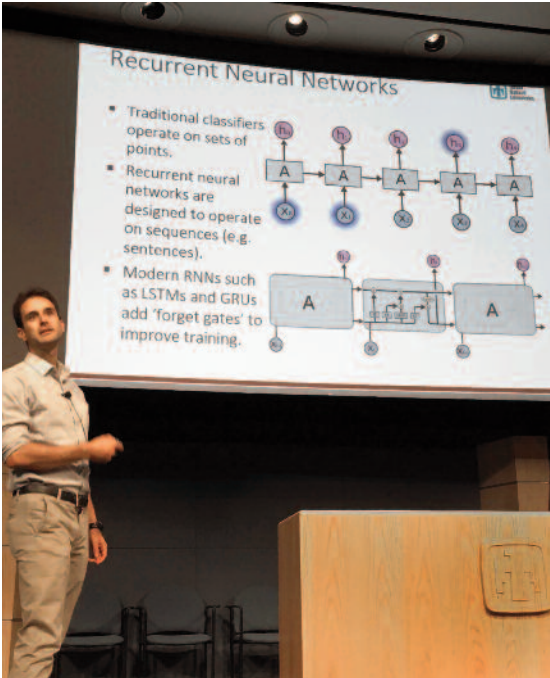
artificial neural network to telling the difference between an earthquake and an underground explosion. Two of the challenges he faced this summer were the limited number of events in his training data and the fact that many seismic events are faint.

These challenges of limited and poor-quality training data are common to many of the applications for which Sandia is using machine learning and deep learning. Several of the talks presented possible remedies for these, and other common challenges.

Systems engineer Matt Kagie (6791) spoke on an evolution-inspired method to get around human bias and

"What if software could learn to recognize complex patterns and then make inferences and decisions along with the human in the loop? Our choice is to wait for industry to provide an answer, or join the forefront of research in this area."

— Conference sponsor Eunice Young



SANDIA COMPUTER SCIENTIST Drew Levin uses deep learning to analyze text from medical records to help detect outbreaks faster. (Photo by Mollie Rappe)

and the six technical Divisions. The conference was held at the Steve Schiff Auditorium and the 904 Auditorium at Sandia/California.

"The types of missions we support generate massive amounts of data and overwhelm the ability of the human in the loop to process the information and make critical decisions in real time," says Eunice Young (6360), a sponsor of the conference. "What if software could learn to recognize complex patterns and then make inferences and decisions along with the human in the loop? Our choice is to wait for industry to provide an answer, or join the forefront of research in this area. This conference pulls together the diversity of thought at the Labs and focuses attention on what we do best: solve difficult problems."

One of Tim's research projects takes speech-recognition-like deep learning algorithms and applies them to challenges in the seismic signal and event detection arena. Determining the difference between a natural earthquake and unnatural underground explosions requires event discrimination and identifying the phase of the seismic waves. "I think those two have a very good chance at being successful," says Tim, because they're similar to the pattern recognition challenges in speech recognition.

Shane Alvarez (6362-1), an intern working with Tim, presented on his work adapting a speech recognition

lution-inspired method to get around human bias and explore a wider variety of solutions in classifying or clustering data. The example he used was analyzing satellite data to classify different kinds of lightning. The unsupervised algorithm included several randomizing methods to try to find the best approach and evaluated itself on a number of criteria before feeding the best solutions back into the evolution stage.

Jacob Caswell (5852), who recently transitioned from a year-round intern to a software engineering staff position, found the conference to be quite helpful. He says, "This is a nice opportunity to see how machine learning and deep learning might pertain to my new position and see how it's being applied all over the Labs. I also got a chance to meet and talk with the people who are actually using machine learning and deep learning."

Tim says he hopes the machine learning and deep learning conference will become an annual event. "The commercial deep learning community has spent a lot of money, a lot of energy, and has invested in a lot of smart people in developing these algorithms for problems that are close enough to challenges Sandia has," says Tim. "I don't think deep learning has really penetrated all the places in Sandia that it needs to yet."

If you missed the conference, you can watch the archived videos online at tiny.sandia.gov/3vca8 or view the presentation slides at tiny.sandia.gov/xdylr.

Sandia’s 20-year mission to stop anthrax in its tracks



SUBWAY TRAINS really move material around so it’s important to see where a surrogate for anthrax would go when released inside a real, operational subway system, says Mark.
(Photo by Randy Montoya)

(Continued from page 1)

These projects focused on specific remediation situations, starting with cleaning up an airport after a biological agent release. Teams of researchers tested available decontamination methods and technologies, learned what current technologies can’t do, researched solutions, and then developed recommendations in case of an airport attack.

Their work progressed through a series of DHS projects to clean up an airport after a chemical release, steps to take in a citywide anthrax attack, and how to scour a subway system after a chemical release.

A critical aspect of cleaning up chemical and biological warfare agents is figuring out what the contaminant is and how far it has spread. Bob Knowlton (6633), a Sandia engineer, has worked on this challenge for a dozen years. His team has developed scientific sampling methods to determine the extent and nature of the contamination. Sampling is also essential to confirm the decontamination was effective and the site is safe to re-enter.

Mark says, “What we’re trying to do is make it so that if somebody does release anthrax into a subway system, we can get the system back into operation as soon as possible while still protecting public health and safety.”

Subway systems are complex with many moving parts and miles of tunnels

The DHS-sponsored Underground Transport Restoration project is wrapping up after four years of research. Mark, Bob, and about a dozen other Sandia researchers and their collaborators at other national laboratories and local, state, and federal agencies have looked at everything from how to clean subway stations and grimy tunnels, to where a surrogate for anthrax would go when released inside the New York City subway system, and the best way to decontaminate a subway car.

In July 2015, in collaboration with the Environmental Protection Agency (EPA), researchers tested the decontamination of a real subway car. At \$3 million to \$5 million each, subway cars aren’t cheap, so operators need to clean them up to get the system back up and running again. Luckily, an extra-strong dose of an industrial gaseous pesticide, methyl bromide, can kill anthrax spores without damaging the subway car, says Mark.

However, the process is time-consuming and subway systems have a lot of cars. For instance, the New York City subway system has more than 6,000 railcars. Bob says, “When you think of the number of railcars and the time and effort it would take to decon a significant number, it’s clear that it’s pretty important to determine if a car has been contaminated.”

Scientific sampling to speed up subway screening

The current way to test for anthrax is to take swabs, send them to a laboratory, and watch for the growth of *Bacillus anthracis* bacteria. To speed up this process, Bob’s team has worked out recommendations for the initial set of samples on the first day after a suspected release to aid decision-makers. These recommendations include suggested swab locations for subway tunnels, railcars, stations, even control rooms.

To reduce the number of swabs that need to be analyzed by the laboratories, Bob’s team looked at ways to improve that aspect of the process as well. The researchers developed methods to handle subway grime on swabs and suggestions for combining several samples in one culture. If no *Bacillus anthracis* grows, then all of those swab locations are clean.

In May 2016, researchers released harmless particles about the size of anthrax spores into the New York City subway system during operational hours. The test required more than 100 people from several national labs, the EPA, and other state and federal agencies to collect thousands of samples to track the spread of particles. The data were used to update a model of the New York City subway system, which can be used to assess the spread of a potential release.

Testing decon methods in a large, mock system

Last fall, Sandia’s team was involved in a large-scale test to figure out the best ways to decontaminate subway stations and tunnels. Subway tunnels tend to be cool and grimy, which makes them hard to clean, Mark says. During the four-week test in the mock subway, the team looked at modifications to several common decontaminants to improve their effectiveness in subway conditions: bleach, common swimming pool chemicals, and Sandia’s decon foam.

In addition to the ingredients of the original decontamination foam — soapy surfactants and mild oxidizers like those found in toothpaste — the new version includes a chemical that helps the decon foam stick to the walls and even the ceilings of the subway tunnel longer, so the decontaminants can kill more of the anthrax. Chemical engineer Patrick Burton (6633) developed this version. Even cooler, Mark says, is that “once the water evaporates, you’re left with a fine powder you can just brush off. It’s a way of overcoming the grime and the temperature problems without creating a mess.”

Sandia’s decontamination foam was originally developed with funding provided by the DOE and NNSA Chemical and Biological National Security Program. It has been licensed to other companies, which have developed it for use in a variety of applications, such as commercial and residential mold remediation, disinfection of hospitals and schools, and pesticide removal for farm equipment.

The other new Sandia technology the team tested was a spray knockdown system partly developed with Laboratory Directed Research and Development funds and refined by Sandia technologist Charles Brusseau. Using a very fine mist of charged liquid droplets, dilute decon foam or even plain water, they can attract and pull anthrax spores out of the air. This could prevent people from breathing in anthrax and might even help stop its spread.

Bob’s team also demonstrated several new technologies to make sampling easier and more efficient. Among these technologies was a smartphone app to make sample recordkeeping more reliable and straightforward for those in the field. The app can also combine the laboratory results and the sample locations into a geospatial tool showing contamination hot spots to aid decision-makers. The researchers have even incorporated these tools into augmented and virtual reality systems.

Findings to be available to subway systems, emergency planners

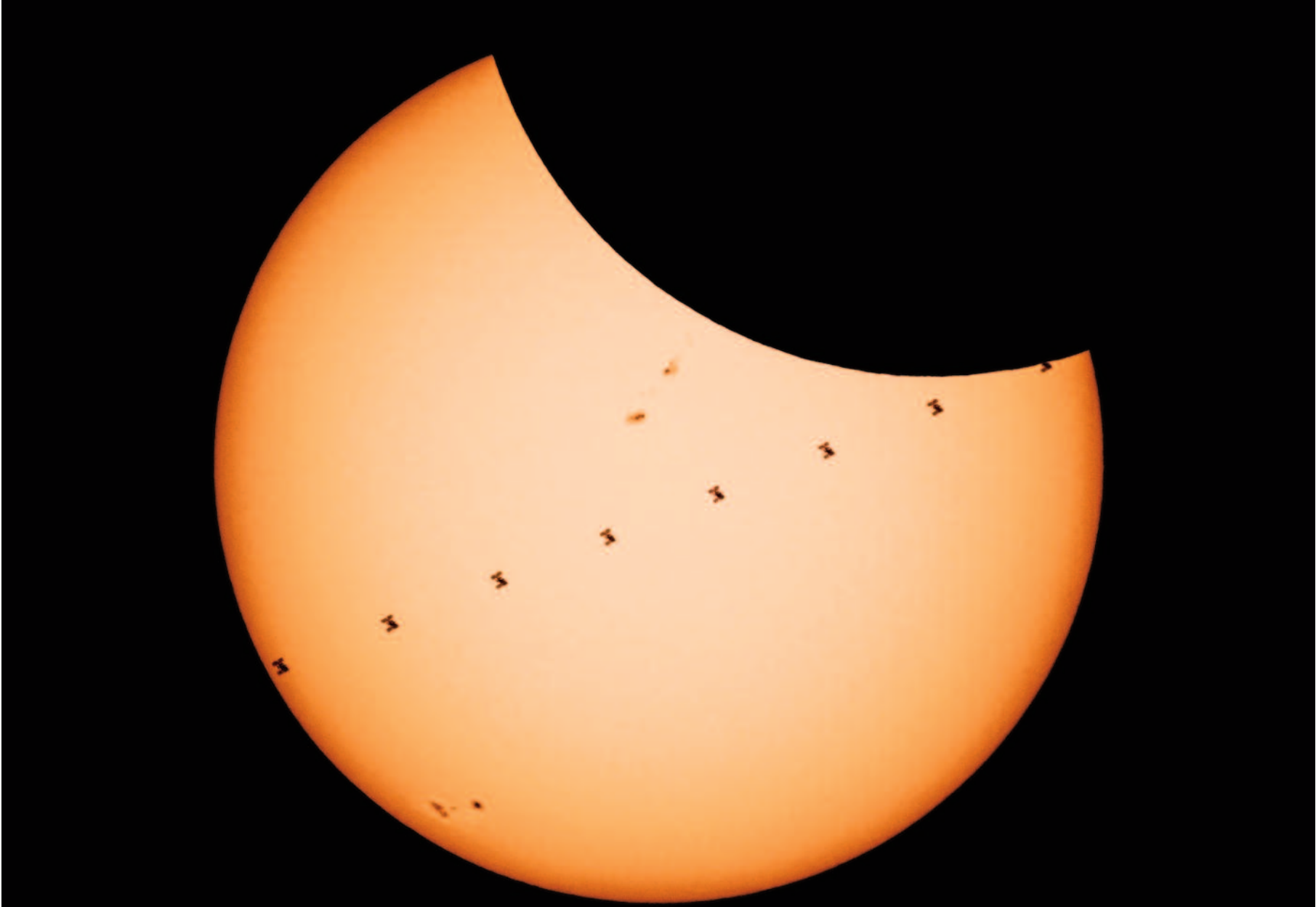
Now that the multiagency group has developed and tested decontamination methods, they’re compiling their findings into an instruction manual that includes guidance to help subways if a biological agent is ever released into their system. The manual will outline all the decontamination methods, with the strengths and limitations of each.

Once the report is completed and reviewed by the pertinent federal agencies, it will be available to municipal subway systems and emergency planners. Previous remediation projects published a 300-page document of their findings, but this project will also transfer its findings into a user-friendly software tool. This software will include a flowchart highlighting decision points. The local, state, and federal responders can select a decision such as “decontaminate subway cars” and see the information they need to make an informed choice.

In addition to DHS and EPA, Centers for Disease Control and Prevention, and MIT Lincoln Laboratory, Lawrence Livermore, Argonne, Pacific Northwest, and Brookhaven national laboratories took part in the Underground Transport Restoration project.

Other Sandians involved in the Underground Transport Remediation project are Toby Chiu, Gabe Lucero, Zach Meinelt, Scott Olson, Melissa Rosenthal, Andres Sanchez, Greg Solomon, Steve Storch, Matt Tezak, and Paul Smith (all 6633) as well as Veronica Lopez (8532), Todd West (8714), Ken Black and John Smith (both 8737), Joe Hardesty (8863), Kurt Hollowell (9322), and J. Bruce Kelley (9422).

ECLIPSE



THE INTERNATIONAL SPACE STATION crosses the sun during the August 21 solar eclipse. Paul Schmit traveled to a very specific site in Wyoming to capture the photo from a unique vantage point that subsequently allowed him to see the total eclipse. The ISS transit took less than 1 second. (Photo by Paul Schmit)

‘The shortest two-plus minutes of my life’

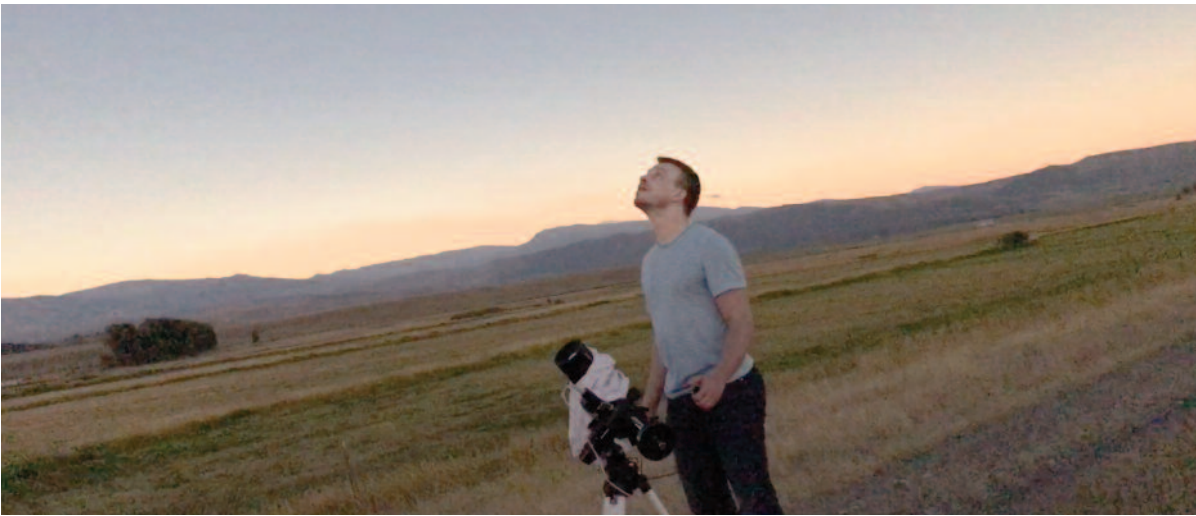
By Paul Schmit, Dept. 1684

I was one of the Sandians who ventured out on August 21 to witness the total solar eclipse that crossed the country. After several weeks of planning and several hours of driving, I navigated to a very particular site in west-central Wyoming in pursuit of a very specific photograph. There, along just a single mile of US Highway 287, just north of the small town of Crowheart, Wyoming, was the only location across the entire country that offered two unique observational opportunities in one place. First, during the early stages of the partial solar eclipse, there was an opportunity to photograph the International Space Station crossing the disk of the sun at the same time the moon was moving into view. The transit was set to occur at 10:43:55 local time, and the entire event would take less than a single second to transpire. Second, this same spot coincided with the centerline of the moon’s path of totality, meaning one could also experience the full two-minute-plus duration of the total eclipse, some 50 minutes after the ISS transit.



DURING TOTALITY, the visible orange and red flecks are earth-sized solar prominences erupting from the sun’s surface. (Photo by Paul Schmit)

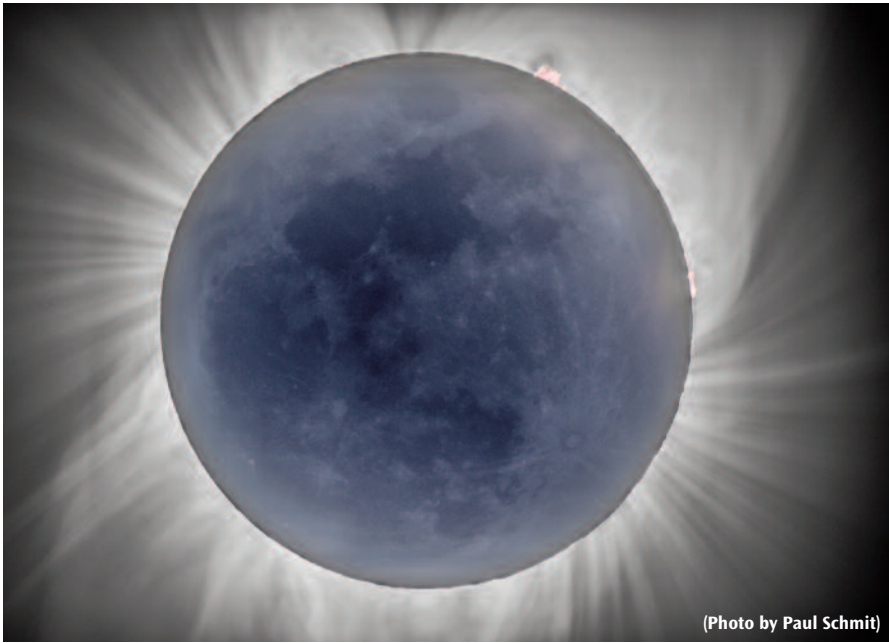
I am happy to report that I was successful in both ventures, documenting the ISS transit and the full extent of totality. I was intrigued by a couple other photographers who also managed to capture the ISS transit, both of



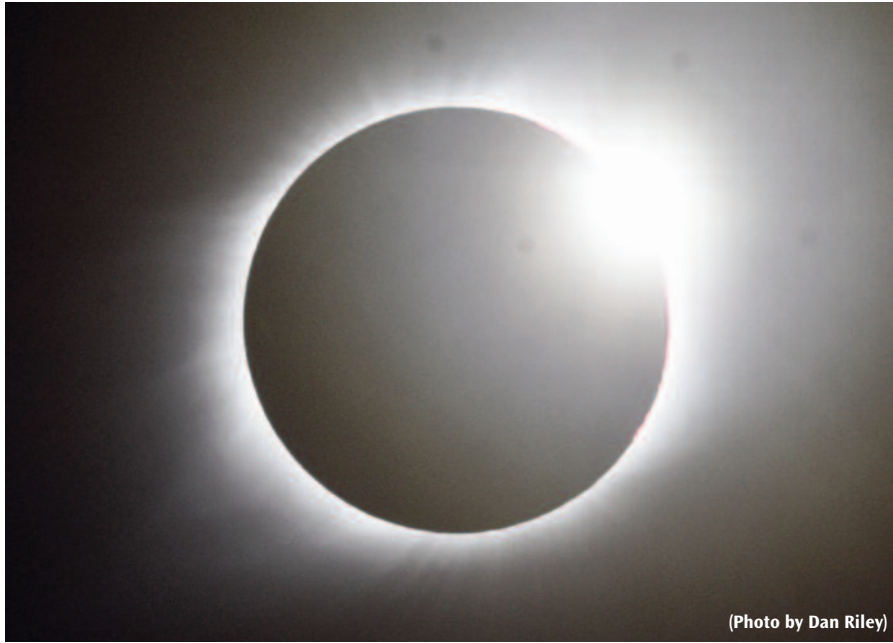
“MY JAW hung open for nearly the entire duration of totality,” says Paul Schmit, which was, he says, “the shortest two-plus minutes of my life.” (Photo by Paul Schmit)

whose photographs were quickly picked up by the *New York Times* and other major news outlets by that evening. Interestingly, in those cases, the photographers were apparently elsewhere, one in northernmost Wyoming, the other in Washington state, both outside the path of totality. As far as I can tell, I might be the only person to document the ISS transit while still enjoying the spectacle of the totality from the same vantage point. I am especially grateful to my colleague, Thomas Mattsson (manager, Dept. 1641), who provided lodging less than an hour from my prospective vantage point the night before the eclipse. The eclipse experience itself was packed with sensory delights. The overpowering brightness of the late morning sky slowly gave way to an almost disturbingly uniform dimness, not like a cloudy day, but more as if I were squinting in broad daylight to look in every direction. The buzz of bees in the fields adjacent to the highway eventually went silent, and in the few minutes immediately prior to totality, swarms of gnats and chirping crickets took their place. As the sun diminished to a tiny sliver, the ambient light became warmer and my dim shadow grew astonishingly crisp, while long, thin streaks of diffuse shadows appeared seemingly out of nowhere and raced across the gravel

shoulder toward the horizon. The sky began to resemble dusk, with a faint orange glow on the western horizon until, suddenly, I realized I could see this glow in every direction. Totality had arrived, and with it came the wondrous view of the sun’s tenuous corona reaching far out into the solar system. Its haunting beauty evoked a sense of profound vulnerability, as it became immediately apparent that we on earth are not isolated from our sun’s expansive ethereal grasp. Distant planets and a few bright stars appeared above as cheers erupted from other observers scattered across the otherwise desolate highway. The limb of brilliant white light surrounding the moon’s silhouette appeared to be adorned with flecks of orange and red, which photographs later revealed to be earth-sized solar prominences erupting from the sun’s surface. My jaw hung open for nearly the entire duration of totality (I have video evidence to prove it), and after the shortest two-plus minutes of my life, the entire event repeated in reverse order, as the orange glow of daylight began to encroach on my location once again. One more glimpse of the ghostly shadow bands racing along the highway marked the conclusion of one of the most awe-inspiring natural spectacles I have ever observed.



THE SOLAR CORONA, visible during totality, reaches far out into space. “The eclipse experience itself was packed with sensory delights,” says Paul Schmit.



THE MOMENT OF TOTALITY approaches, bringing with it “a vague unease as the midday twilight quickly turns to total darkness,” says Dan Riley.

Whoops of elation then awestruck silence

By Dan Riley, Dept. 8824

As a photovoltaics engineer, a key part of my job is measuring solar radiation. And as you’d expect, an interest in all things solar is a natural outgrowth of the job. I’d found the 2012 annular eclipse that was visible here in New Mexico interesting, but I’d read that a total eclipse is in a class to itself. So, about 18 months ago, when I learned that a total solar eclipse would occur in the continental US for the first time in 38 years, I knew this was something I couldn’t miss. I began to make plans to see it. On Aug. 18, I packed my three oldest children (10, 8, and 6) in the car and we headed for central Missouri, directly under the umbra (shadow) of the moon. I’d planned meticulously: I’d rented a very long camera lens, I’d ordered viewing glasses months ago, and I’d plotted out five potential viewing locations across the state of Missouri in case of heavy cloud cover. Yet, on the eve of the eclipse, I still felt very nervous about the next day. I was just north of Jefferson City, which had a forecast of 50-60 percent cloud cover, not ideal viewing conditions. Forecasts to the northwest were even worse. Late on the 20th, I decided to go to my backup location to the southeast, St. Clair, where a friend of my aunt was hosting an eclipse viewing party and forecasts predicted only 30-40 percent cloud cover. That looked to be my best option.

As we drove through downtown St. Clair (population 4,700) on the 21st, it was clear that the eclipse was a very big deal. Non-Missouri license plates outnumbered Missouri plates 3 to 1 and businesses were charging \$5 to \$10 to park in their lots. We arrived early and set up lawn chairs, cameras, and the irradiance measurement equipment I’d brought along. The kids ate Moon Pies and Sun Chips, successfully avoiding eating anything of nutritional value while I was preoccupied with equipment and taking photographs. About an hour before the eclipse began, a layer of high clouds threatened to foil all my plans, but thankfully they had mostly cleared out by the time the eclipse started. As

totality approached, the anticipation was very high — even my children were excited as the sun became a tiny sliver peeking out from behind the moon. There is an eerie feeling when totality is near. It’s tough to pinpoint the cause of the strangeness, but there is a vague unease as the midday twilight quickly turns to total darkness. When the long-anticipated moment arrived, the entire party wondered at the marvel of the total eclipse. Whoops and cries of elation rang out all around as observers cheered the arrival of totality. These cries quickly died down as we shifted focus to the perfect ring of light. Most of the adults then stared in near silence, while children repeatedly yelled, “That is so cool.” When viewed by eye, the coronal streamers didn’t stretch as far as I’d seen in pictures, but they were beautiful nonetheless. I snapped as many pictures as I could over a wide range of shutter speeds while trying to simultaneously view and remember the sight. During an eclipse, the focus of interest is on the sun and moon, but there are other points of interest, too. Venus could clearly be seen, and there was a definite glow on every horizon. For that wonderful 2.6 minutes, we almost felt we were in a different reality. Totality finished entirely too soon but for a minute after totality we could view shadow bands on the ground caused by turbulence



DAN RILEY says his typical position throughout the day was lying down behind a camera documenting the total eclipse. (Photo courtesy of Brad Gassner)

in the atmosphere creating a fluctuating lens for the slim crescent sun. As the eclipse continued after totality, we watched the second partial phase, although with much less enthusiasm since the real spectacle had already occurred. There was broad consensus from our group that the eclipse had easily lived up to the considerable hype and by the end of the cosmic event I had already decided that I would see the next US-crossing total eclipse in April 2024. The 2024 umbra will trace a path northeast from Dallas to Indianapolis, over Lakes Erie and Ontario, finally leaving the US through Maine. And next time, my entire family will certainly be traveling to enjoy this rare and beautiful event.



“FOR THAT WONDERFUL 2.6 minutes, we almost felt we were in a different reality,” says Dan Riley.

(Photo by Dan Riley)

Downtown bound

Sandia opening an office in the heart of Albuquerque’s innovation district

By Nancy Salem

Sandia will open an office this fall in the University of New Mexico’s Lobo Rainforest, a 160,000-square-foot multiuse building that is the first piece of Innovate ABQ, the seven-acre downtown hub of the Innovation Central district in Albuquerque.

“Sandia is an integral part of the high-tech business community along with UNM, the Air Force Research Laboratory, and many others who are committed to improving the New Mexico economy,” Dave Douglass, Sandia’s deputy labs director, said to a standing ovation at the Aug. 25 Rainforest ribbon-cutting. “Sandia is proud to be part of Innovate ABQ and proud of the robust partnerships we have formed to advance economic development in the state.”

Innovate ABQ is a public-private partnership created to develop a seven-acre innovation center in downtown Albuquerque to foster economic development and job creation in New Mexico. It aims to develop more than 600,000 square feet of dense, walkable space devoted to bringing together New Mexico’s innovators to foster the creation of long-term, job-creating ventures.

The Rainforest is at the site of the old First Baptist Church building at Central and Broadway avenues. It will house Innovate ABQ tenants, UNM’s Innovation Academy, and a student dorm with the goal of bringing together economic and academic programs.

Sandia signed a lease in August for office space in the Rainforest, and plans to open a downtown node for its Center for Collaboration & Commercialization, or C3, in late September. C3 is designed to strengthen partnerships, technology transfer, and ties to the community, and offers programming and services to boost Sandia’s interaction with industry, academia, and government.

Called C3 Downtown, the new office will focus on programs that move Sandia-developed technologies into the commercial marketplace. The office will have one full-time staff person, a part-time manager, and other staff members holding regular office hours. It will



RAINFOREST PRESENCE — Deputy Labs Director Dave Douglass told the crowd at the University of New Mexico Rainforest ribbon-cutting that Sandia will open a technology-transfer-focused office in the multiuse building. The announcement brought a standing ovation. (Photo by Linda Looker)

also be a landing place where other Sandians can drop in and work.

Community members will be able to meet with Sandia staff to discuss licensing, Cooperative Research and Development Agreements, the New Mexico Small Business Assistance program, and other technology transfer programs. The office will also host representatives from Sandia’s supplier and community relations organizations and the Labs’ Entrepreneur Exploration program, which links scientists and engineers with business opportunities and resources provided by a variety of partners.

“C3 Downtown will bring Sandia’s tech transfer team together with colleagues from UNM and the Air Force Research Laboratory. The three tech transfer organizations working together will collectively increase the impact of our work,” says Susan Seestrom, Sandia’s chief research officer and associate laboratories director for Advanced Science and Technology Div. 1000. “Sandia looks forward to being part of the vibrant entrepreneurial and startup ecosystem in downtown Albuquerque. Working together, Sandia, the city, UNM, and all our local partners will be a powerful force spurring innovation and economic growth in our region.”

Pollution prevention week

By Stephanie Holinka

Pollution Prevention (P2) Week is Sept. 18-24 this year. From offices, to the cafes, to the laboratories, Sandia is working on meeting an ambitious environmental goal by finding ways to buy smarter, reuse, and recycle.

“Striving for zero waste is more than just recycling. It starts earlier, by making smart choices on purchasing new items that will have a long life and can be recycled at the end of that useful life. It also involves keeping things out of the landfill by reusing items, and only then recycling items at the end of their life,” says environmental technical professional Ralph Wrons (4736).

In 2008, Sandia committed to making the Labs a Zero Waste facility by 2025 for non-hazardous solid waste, which is primarily office waste. Sandia today is at about 70 percent of that goal, reducing waste by more than 380 tons. Additionally, Waste Management has set a goal of half of a pound or less of trash per week per person.

Waste Management periodically audits the trash to see what types of things people are throwing away, and what is going in the trash that really should be reused or recycled.

Many organizations work together to support these goals.

Sandia’s JIT contracts for things like electronics, paper shredding, toner purchase, and others are designed to foster the purchase of items with less toxic constituents, less packaging that must be discarded, and to encourage recycling.

Café improvements

Taher Food Services, Sandia’s new cafeteria provider as of June 2017, is working on several pollution prevention and recycling goals (that were added to the contract scope of work). Dietician Lisa Teves (3334), Sandia’s designated representative for the Taher contract, worked with the new cafeteria provider on ways to make the cafes more environmentally friendly.

Lisa says Taher will phase out Styrofoam use in all its cafes over the next six months. Taher is evaluating replacements that are more environmentally friendly and also economical, since Styrofoam costs a few cents per item, while eco-friendly disposable items can run 40-50 cents per item.

The cafes continue to recycle aluminum cans and



plastics at all its locations and continues to compost food waste from the cafes.

Diners can also save the gas it takes to drive to distant lunch locations by ordering their food using drop-off locations at Bldg. 6585, CERL, and Bldg. 823 refrigerator locations and delivered at 11 a.m.

Taher is also offering refillable cups for fountain drinks and coffee, with a discount for refills.

Food composting was initiated with a pilot in 2010, and was expanded in 2012 to the Bldg. 960 café.

Areas to improve

Sandia is doing lots of good things, but there are some areas for improvement, Ralph says, adding that audits have found that mixed paper and rigid plastics 1-7 make up 45 percent of remaining trash.

“We can do better in diverting both mixed paper and the plastics to the recycling bins located throughout the campus,” Ralph says.

Another area that Sandia can do better is re-thinking binder use, he says.

“A huge source of office waste is binders. They aren’t recyclable. When people clean up their offices to move or retire, all those binders that have sat in their office, unused for years, typically go into the trash,” Ralph says.

In addition to the binders, there’s the paper that goes into them.

“With Sharepoint, shared directories, EIMS FileNet, Outlook folders, and personal e-folders, we have very little reason to print paper,” Ralph says. And when we do print it, it’s probably easier to file in marked manila folders, and then placed in file drawers.

“Printing less is also better for information security. The less of that you print, the less rigor you must have with proper disposal of it,” he adds.

Prevent pollution wherever you are

Help Sandia meet its goal wherever you happen to be at the Labs:

In the office

Since office waste is the focus of Zero Waste, focus on preventing office waste before it happens.

- Avoid Binder waste — Binders are not recyclable. Avoid purchasing binders for printed information that is more easily kept current if stored on the corporate network. If it must be printed, use file folders to store. Consider reusing binders where possible from one of the binder reuse locations.
- Mindful printing — That meeting agenda that will be discarded shortly after the meeting probably doesn’t need to be printed. Do you need a new printer in your office, or can you use a locally networked Fleet Copier (multifunction for printing, copying, scanning and even fax)?

- Assess the need for calendars — How much do you use that printed calendar? If it’s not much, consider skipping it for this year.

In the cafe

- Recycle — Coffee cup lids and plastic utensils can be recycled.
- Reuse cups/containers — The cafes currently offers reusable cups for hot and cold beverages, and will soon be offering reusable food containers.
- Dump out liquids — Liquids are prohibited from Sandia’s trash dumpsters, and should be removed from recycled items prior to disposal.

In the laboratory

- Recycle plastic bottles — Empty 858 rinse bottles and all plastic bottles that never contained caustic materials are recyclable.
- Recycle #2 plastics — #2 plastic is the most valuable plastic to recyclers, and is directly 100 percent recycled to new #2 plastic products.



Meet Sandia’s RODEO QUEEN

By Kristen Meub

Every night of the New Mexico State Fair, Shay Williams (3010), rides her horse Buddy in the grand entry along with forty-some other riders and their horses, traveling in a serpentine pattern and holding a flag while the crowd cheers them on. This moment is just one of many that make up her duties as the crowned 2017 Bernalillo County Rodeo Queen and a contestant in the New Mexico State Fair Rodeo Queen contest.

“Winning or not, I just wanted to have that experience of running for queen because it looked like so much fun,” Shay says. “Representing my county and New Mexico sounded like a great experience.”



RODEO QUEEN Shay Williams, a year-round graduate intern in diversity and inclusion, is the 2017 Bernalillo County Rodeo Queen and is competing in the New Mexico State Fair Queen contest.
(Photo courtesy of Shay Williams)

Preparing for a career in human resources

Shay studies strategic management and policy at the University of New Mexico’s Anderson MBA program and is a year-round graduate intern for Sandia’s diversity and inclusion department. She holds a bachelor’s degree in business administration from UNM with a concentration in human resources and appreciates the hands-on experience she gets at Sandia.



QUEEN’S RUN Shay Williams practices for the queen’s run, one of several horsemanship events that are part of the New Mexico State Fair Queen contest.
(Photo by Randy Montoya)

“It’s been exciting and very independent,” Shay says. “I’ll get a project and my team lets me run with it, whereas other jobs I’ve had involved a lot less ownership and more oversight. I also feel like an employee and not a number, even with 10,000 employees in Albuquerque.”

Shay works on brochures and posters for Sandia’s equal employment opportunity program, develops materials about diversity and inclusion programs for new employees, and is considering how new video programs could enhance diversity and inclusion learning for the workforce.

The life of a queen

When Shay isn’t studying or working, she shows and cares for her family’s four miniature horses and has a full schedule of Bernalillo County Rodeo Queen events. To win the Bernalillo County Rodeo Queen title, Shay competed in three horsemanship events — a set pattern, a free time pattern, and a queen’s run — and did a personal interview, a speech, western wear modeling, and answered an impromptu question: “What intimidates you?” Her answer was public speaking, and she says she’s not alone.

“I heard a statistic that public speaking is the second highest fear people have in the US, right after death,” Shay says.

Despite her fear of public speaking, Shay is proud to be Bernalillo’s queen, and is using the opportunity to meet with local children and talk about the importance of working toward goals.

“As a queen, one of my goals has been to talk with youth about being more confident within themselves and following their dreams,” Shay says.

From Sept. 14-16, Shay is competing to win the New Mexico State Fair Queen title, which includes horsemanship events, speeches, modeling, personal interviews,

and a written test about the state of New Mexico and the New Mexico State Fair Rodeo. At each event she’ll wear a hat, a long-sleeved shirt, jeans, and boots. Shay says that “rodeo queen dress is very conservative and not like Miss America when they wear bikinis.”

“The queen is supposed to be someone who is well-rounded in rodeo and personality; someone who works hard,” Shay says. “Someone who can get on a horse with the drop of a dime, but also someone who can have a conversation with you and be an ambassador for the sport of rodeo.”

Cami Belcher, a fellow Sandian and the 2016 New Mexico State Fair Queen, worked with Shay to prepare for the competition by helping her plan her speeches, pick out clothes, and even style her hair in the rodeo queen fashion with wings that curl away from the face.

Miniature horses and a foundation in rodeo

Shay enjoyed going to rodeos throughout her childhood, but says showing Reina, Star, Brew, and Blue — her family’s four miniature horses, is her foundation in working with horses. She and her family have won titles in several categories, including driving and western pleasure. Shay and Brew, a 22-year-old gelding, earned a national championship in showmanship last year in Tulsa, Oklahoma.

“Showmanship is basically how you present yourself,” Shay says. “It’s how you hold yourself and your horse. Brew and I are a great team. He’s my old man, but he still acts like he’s super young and can get pretty spunky.”

You can watch Shay compete Saturday, Sept. 16 at 8 a.m. in Tingley Coliseum as she completes her second run in horsemanship in her run for this year’s New Mexico State Fair Queen Title and also at the rodeo Saturday night where the results of the competition will be announced.

Honoring technological advancements

By Mollie Rappe

Sandia recently recognized staff members who have contributed to the Labs’ technological achievements and intellectual property portfolio.

Up & Coming Innovators, nominated by their Centers, honored early career Sandians who display the potential to make significant contributions to the Labs’ intellectual property portfolio. Mission Innovators, nominated by their Divisions, were recognized for their innovations in support of Sandia’s national security missions.

“Innovation is a core value for Center 5800 and I am extremely proud of the extraordinary impact 5800 staff have on our sponsor’s missions. The Mission Innovation and Up & Coming Mission Innovator awards offer a way to recognize our staff’s outstanding contributions to national security,” says Jim Hudgens, director of Information & Systems Research & Analysis Center 5800.

The awards were sponsored by the IP Management, BCI, & Business Development Dept. 1182.

Up & Coming Innovation Awards

Ryan Coe (8822), Paul Cummings (5874), Mark Gramann (5447), Nicholas Leathe (2616), Thomas LeBoeuf (5845), Matt Marinella (5268), Kelsey Meeks (2614), Brendan Nation (1851), Reymundo Rael (6532), Ina Sava Gallis (1874), Leo Small (1816), Nathaniel Spangler (6532), Anna Tauke-Pedretti (5264), Amanda Wachtel (8834), Andy Wantuch (9365), and Ian Zedalis (5823).

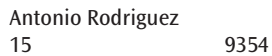
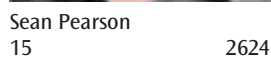
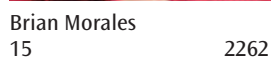
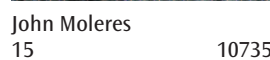
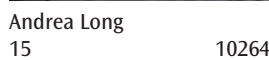
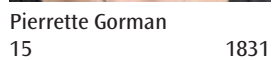
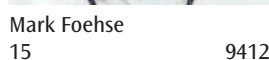
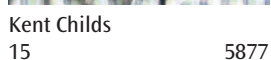
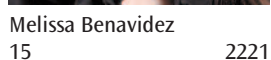
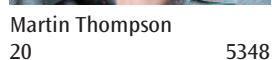
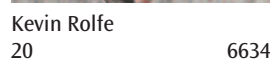
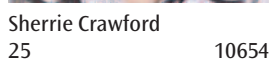
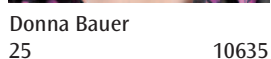
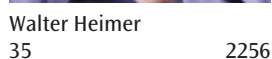
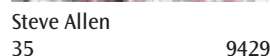
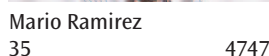
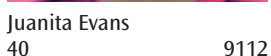



RESEARCH ENGINEERS Ryan Coe (8822) and Giorgio Bacelli are collecting new information to optimize wave energy converter testing. Ryan is an Up & Coming Innovation Award winner.
(Photo by Randy Montoya)

Mission Innovation Awards



Tom Awe (1688), Tim Boyle (1815), David Calkins (1833), Phil Callow, Jr. (2635), Joe Cordaro (8344), Patricia Cordeiro (5852), Emily Donahue (5334), Tim Drummond (2325), Chris Dyck (5865), Irenea Erteza (5862), Adam Flynn (5845), Michail Gallis (1513), Casey Glatter (5828), Eric Harding (1683), Derek Hart (5824), Jordan Henry (5828), Ryan Hess (1815), Alan Kruienza (8222), Brent Kucera (5832), Thomas LeBoeuf (5845), Keith LeGrand (6773), Joshua Mabey (9428), Kellen Madsen (8226), Sita Mani (2241), Matt Martin (1641), David

McGrogan (5831), Jason Meeks (5844), Tim Meisenheimer (5877), William Miller (1833), David Moore (1529), Stan Moore (1444), Cameron Musgrove (5332), Greg Pickrell (1873), Steve Plimpton (1444), Brian Podolny (5837), Donald Potter (1515), Somuri Prasad (1851), Will Rice (5877), Danny Rintoul (1462), Charlie Robino (1831), Bob Sayer (2243), Paul Schmit (1684), Jason Sonnek (5837), Peter Stromberg (6356), Scott Strong (6332), Rick Strong (5832), Andrew Targhetta (2244), Douglas Thompson (5242), Roger Vesey (1684), Gareth Whatcott (8222), Andy Wilson (1461), and Kyle Zufelt (2243).





HISPANIC HERITAGE MONTH

“Reflect, Reboot and Rebuild our Culture”

Sept. 18 Art Contest Judging and Food Tasting Event
CGSC/Bistro (northeast of IPOC)

- ❖ **11:00 a.m. – 1:00 p.m.** – Open voting for student art contest – View and judge amazing youth art from local schools.
- ❖ **Hispanic food tasting**

Sept 19. Diversity Event Day
Hardin Field





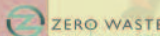
- ❖ **11:00 a.m. – 11:10 a.m.** – Opening comments from Hispanic Outreach for Leadership and Awareness (HOLA) Chair, Rita Gonzales
- ❖ **11:10 a.m. – 11:40 p.m.** – Education/Awareness in Cultural Dance, “Los Bailarinas de Oro”
- ❖ **11:45 p.m. – 12:00 p.m.** – VIPs: Scott Aeilts, Jeff Harrell, and Colonel Harner & Guest Speaker, Mr. Quezada
- ❖ **12:00 p.m. – 12:15 p.m.** – SAMBA SIZZLE/Latin dance workout with Lisa Jaramillo
- ❖ **12:15 p.m. – 1:00 p.m.** – Education/Awareness in Cultural Music: The Solarez Band, members include Ken Armijo, Roy Lopez, and Jesus Ortega from Sandia Labs.

Food Trucks Available from 11 a.m. – 1 p.m. CASH ONLY

- ❖ Purchase food at the food truck of your choice:
 - ❖ Brooke’s Carryout, La Rivas New Mexican, Pop Fizz, Saep Fire, and Street Food Institute

Winning Art from the Student Art Contest will be on display.

Contact Keith Vigil for more information @ 844-6782 or kgvigil@sandia.gov

SANDIA CLASSIFIED ADS

MISCELLANEOUS

KNEE SCOOTER, w/large pneumatic wheels, light indoor use only, like new, \$150. Prior, 505-239-9586.

PLAYGROUND, Lifetime from Costco, huge, nice double slides, metal body, solid quality, \$1,500. Amador, 505-259-8919.

DINING ROOM SET, w/china hutch, mission-style, oak, w/8 chairs, 2 leaves, extends to seat 10, excellent condition, \$1,750. Legan, 505-239-1027.

ENTERTAINMENT CENTER, oak, large, \$1,500; futon, w/5-in. mattress, \$50; dining room table, w/8 chairs, \$300; 6' x 10' dog kennel, \$125. Buck, 353-2667.

MEXICAN DINING SET, elegant, dark finish, vintage, babied, table, 8 chairs, buffet, cabinet, large, \$2,500 OBO. McNamara, 505-720-4946.

DINING SET, 42-in. glass-top table, 4 upholstered chairs, excellent condition, \$1,500. Wells, 505-292-0179.

MIRROR, free-standing, wood-framed, Umbra of Canada, 14" x 61", pristine condition, \$23. Wagner, 505-504-8783.

WASHER & DRYER, Maytag Performa (washer), Maytag Atlantis (dryer), good condition, you pick up, \$350. Finston, 856-3507.

MIXER/BLENDER/GRINDER, Oster Regency, Kitchen Center, 10-spd., w/attachments, made in USA, \$120 OBO. Ghanbari, 505-400-4360.

COMMUNITY YARD SALE, Sat. Sept. 23, 9 a.m.-1 p.m., Encanto Village, SE corner of Bridge Blvd. & Unser. Vigil, 400-0639.

LOVESEAT & CHAISE, moss colored, purchased in 2014, excellent condition, paid \$1,364, asking \$500/set. Hussong, 505-280-4307.

CARGO TRAILER, Sport 20, w/hitch/bracket for extra hauling, used w/motorcycle, East Mountains, \$275. Willmas, 505-281-9124.

CARD TABLE, folding, w/4 chairs, \$25; 2 table lamps, metal umbrella shades, stone base, \$40 ea. Drebing, 293-3335.

MODEL HORSES, Breyer brand, various sizes & prices, some limited edition. Wheeler, 505-507-4457, send text.

SLEEP NUMBER BED, queen, model P5 w/mattress cover, great condition, \$1,400 OBO. Witt, 505-991-1878.

ELLIPTICAL, ElliptiGO Arc 8, black, brand new, rode it once, photos available, paid \$1,200, asking \$900. Pacheco, 505-816-8501.

TRANSPORTATION

'99 OLDSMOBILE ALERO, still runs but would be best as a parts car, \$1,200 OBO. Ruiz, 575-650-2858, ask for Wendy.

'11 LEXUS RX450H, fully loaded, 86K miles, \$19,500. Sivage, 505-259-7115.

'13 VW PASSAT, 5-cyl., 6-spd., AT, 20K miles, excellent shape, \$16,250. Boruff, 505-239-1026.

'94 CHEVY CORVETTE CONVERTIBLE, AT, red, 101,027 miles, excellent condition, \$10,000. Arguello, 575-268-8237, ask for Ben.

'98 Ford F150, excellent, no accidents, one owner, new headlights, brakes, struts & shocks, 161K miles, \$4,500. Montoya, 342-0043.

'03 HONDA CIVIC SI, 2-dr. hatchback, 115K miles, \$4,000. Hanks, 505-249-1931.

'95 F350, PowerStroke, 7.3L, 4x4, 4-dr., long bed, manual, 180K miles, good condition, \$12,000 OBO. Widerkehr, 505-507-0774.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

'14 FORD SVT RAPTOR, super-crew, 6.2L, V8, 4WD, leather, heated/cooled seats, power moonroof, navigation, remote start, alloy wheels, \$43,000 OBO. Shaw, 505-239-1517, ask for Richard.

RECREATION

TOY HAULER CAMPER TRAILER, 14'L x 7'W, 6'x6' tall, \$5,000 OBO. North, 505-715-7430.

'05 HONDA GOLDWING, w/satellite radio, 32,200 miles, \$9,500. Young, 505-280-5843.

REAL ESTATE

5-BDR. HOME, 3 baths, 4,280-sq. ft., in-law quarters, swimming pool, Four Hills, pre-inspections done, \$444,000. Ramos, 972-951-0290.

INCOME PROPERTY, home, 2 apts., mobile home, Las Vegas NM, nice size lot. Herrera, 505-890-4304.

4-BDR. HOME, 1-3/4 baths, 2-car garage, refrigerated air, recently remodeled, open floor plan, appliances, 1825 Carol NE, \$164,900. Langwell, 505-350-1313.

4.25 ACRES, currently categorizes as agricultural, Jarales NM. Parker, 505-453-7405, ask for Lorraine.

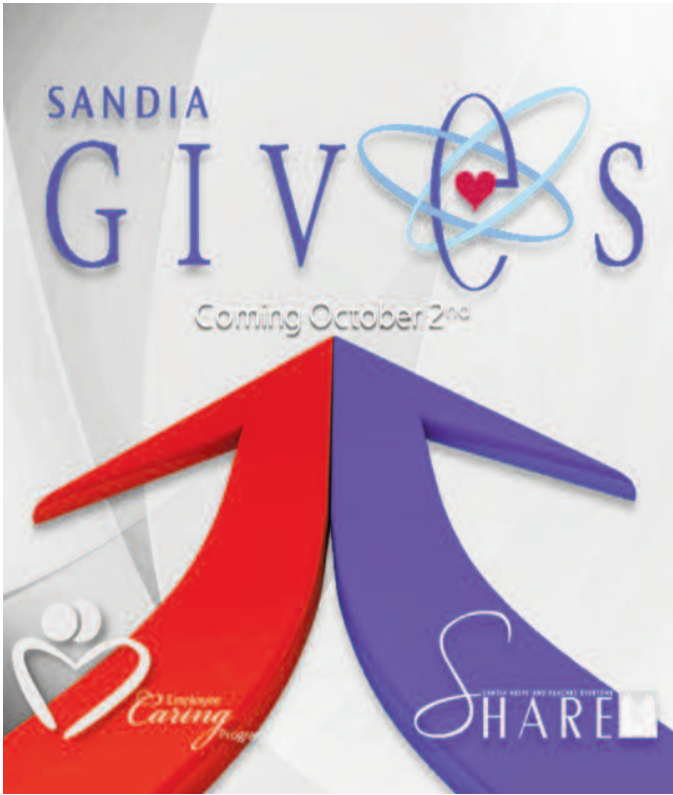
3-BDR. HOME, 2 baths, large barn, shop, 5 acres, Edgewood, mountain views, <http://tinyurl.com/y7koy7kx>, \$299,000. Tucker, 505-281-5693.

3-BDR. HOME, passive solar, active hot water, country living 6 miles from Eubank gate, Zillow, \$214,950. du Mond, 291-5805.

WANTED

BERNINA SEWING MACHINE, good condition. Dykhuizen, 281-6892.

VENDORS, Canterbury Craft Fair, Sat. Oct. 28, 425 University Blvd. NE. Hughes, 505-220-8977.



Steve Girrens

(Continued from page 12)

can still see them as much as possible," he says. Daughter, Quinn, was married last year and his son, Craig, is heading down the aisle this October.

Career highlights and looking ahead

During his tenure at LANL, Steve spent more than 35 years working in many facets of engineering, including design, computational analysis, prototype testing, and transition to manufacturing.

"The biggest impacts in my career and my greatest technical contribution is the talented people I've hired. My satisfaction has been seeing the success of those people through the years. They're now hiring and bringing in that talent to the enterprise."

In full-circle fashion, four decades after he originally applied to Sandia, Steve joined the NTESS contract as the Associate Laboratories Director for Nuclear Deterrence. He and Sharon are once again using the outdoors to acclimate to Albuquerque.

"We bought a home in an area where we could hike and mountain bike on the weekends."



STEVE GIRRENS on a recent visit to his uncle's farm in Kansas. (Photo courtesy of Steve Girrens)



WELCOME COACH — Sandian Ken Hernandez (front row, third from the right) welcomed his former Little League coach, Steve Girrens (back row, far right), to Sandia by emailing him this photo, circa 1983. (Photo courtesy of Steve Girrens)

Though much of his time in recent months has been consumed by the transition, Steve says he's trying to restore balance in his life and he thinks it's important for all of us.

"It's a work in progress," he says. "The job can eat up as much time as you can give. It's true in any position. Sandia is a living organism — our people have great minds sitting atop living bodies. I'm always worried about balance, mentors, succession, the health of the organism. It's got to relax, breathe, think, learn, exercise; it ebbs and flows. The organization evolves, adapts over time."

Between learning the ins and outs of Sandia, meeting with sponsors in D.C., visiting Sandia/California and the Kansas City plant, working on his first annual assessment review at Sandia, and helping to oversee the Labs' largest nuclear weapons workload in more than 30 years, Steve says he is humbled by what he's seen in his first four months.

"This is the job of a lifetime for me," he says. "I want to add value here. When I see the talent involved in performing our mission, I think, 'How did I get this lucky?' It is such an honor to be here. I take that honor and responsibility very seriously."

Life lessons from the farm: responsibility, shared fate, effectiveness

By Jennifer Awe

Steve Girrens, Associate Labs Director for Nuclear Deterrence Div. 2000, discusses his Kansas roots, how he found Los Alamos, and what being at Sandia means to him.

Growing up on a wheat and dairy farm in Schulte, Kansas (near Wichita), Steve Girrens was driving a tractor when some kids were learning to ride a bike.

His grandfather owned a farm that grew and grew, due in large part to his family’s entrepreneurial spirit. “Half the farm was taken by eminent domain when they built the Wichita airport and my dad and grandfather saw an opportunity (circa 1954),” he recalls. “To make a living, my dad was working at the airport and he made a deal with them to farm a portion of the unused land. That deal lasted for decades.”

The farm expanded along with the airport and the Girrens family was farming close to 1,500 acres of airport land during its peak in the 1970s.

“There is always so much to do on a farm,” says Steve. “It presents you with as much responsibility as you can handle, as early as capable.”

Steve’s dad inherited the farm from his grandfather and as the eldest son, Steve became a partner in high school.

“My dad said, ‘This is your field,’ he recalls. “What a responsibility, but it’s the only life I knew. I enjoyed it.”

One of the first lessons instilled in the wheat fields, was that of a shared fate.

“If there’s no crop, no one eats,” says Steve. “It becomes an intrinsic all for one and one for all. I think that mentality applies to all of us at Sandia and across the enterprise as well. In order to get the work done for the good of the nation, of the world, it means all forces working together.”

At 19, Steve moved into his own home on the farm — the original farmhouse — and attended college full time at Wichita State University.

“I remember the first few tests during fall semester were always the hardest,” he says. “The end of September, early October was wheat planting season and we had much to do. Once I got through that, the school year would become easier.”

Farming also taught Steve lessons in efficiency and how to optimize.

“We would never buy a new tractor or equipment if we didn’t absolutely need it — only when we had to,



ON THE SLOPES — Steve Girrens and wife Sharon skiing at Pajarito Mountain in Los Alamos. (Photo courtesy of Steve Girrens)



FAMILY MATTERS — Steve Girrens, on right, with wife Sharon, left, and son Craig and daughter Quinn at Quinn’s September 2016 wedding. (Photo courtesy of Steve Girrens)

not because we wanted to. It didn’t have to be excellent, it had to be effective. My parents didn’t have much and they stretched everything.”

That pragmatism led Steve into the engineering field. After scoring well on the math ACT, an engineering professor presented Steve with some numbers.

“He showed me what an engineer made right out of the gate and talked about the exciting, hands-on work I could do and I said, ‘I’m in.’ I was ready to work and make a living right away.”

Greener pastures

After college, Steve left the family farm in the hands of his father and younger brother to look for the next opportunity. He sent cover letters to Sandia and Los Alamos national laboratories, and to several private engineering companies.

“I had never heard of the labs, but my professor told me about the work and I thought they sounded like the coolest places on earth.”

In 1979, he accepted an offer at Los Alamos National Lab. In addition to believing in the mission and thinking the work was “so cool” he was immediately drawn to the outdoor amenities on the hill.

“I didn’t have any city life to miss. Outside of work, I was consumed by recreational activities. My friends and I loved skiing Pajarito and we built softball fields in White Rock.”

It was there in a field of a different kind where Steve met Sharon, his wife of 34 years. She was working in Parks and Recreation for Los Alamos County while he was building his softball “legacy.” For decades, he played softball and coached baseball on those fields. He coached University of New Mexico standout Alex Kirk, who played basketball for the Cleveland Cavaliers, along with many kids who went on to work at Los Alamos and Sandia national labs.

One such kid, Ken Hernandez (2276), would later welcome him to Sandia.

“On my second day here, I get this email with the subject, ‘welcome coach,’ and Ken sent a nice note welcoming me and sharing a photo of when I coached him back in 1983!” he says. “People have been welcoming and accepting and I appreciate that.”

Sharon and Steve married in April 1983 and he

began his PhD program in August 1983 at Colorado State University.

“Sharon had her community in Los Alamos and I had mine and we left to move to Fort Collins,” he says. “That’s when it became *our* life. I think starting a life together in a new place was the best way to become a stronger couple. We loved our time there.”

Sharon’s father was also a Kansas farm boy, who was sent to Los Alamos during World War II. Her mother is from the Pojoaque area and her side is rich with histories of working at LANL.

Apart from two assignments in Washington, D.C., one where he worked in NNSA’s Office of Defense Programs, Steve and Sharon raised their two children in Los Alamos. The family’s free time was spent skiing, hiking, golfing, and volunteering in the community.

“My kids had a very different upbringing than mine,” he says. “It was important to us that they see life outside Los Alamos.” Steve and his family made seven trips to Mexico over the years to help build homes in poverty-stricken areas.

Today, the couple’s children both live in Denver, which means it’s just a short trip to reunite.

“Though they’re grown and making families of their own, our master plan is to schedule family trips so we



STEVE GIRRENS, Associate Labs Director for Nuclear Deterrence Div. 2000. (Photo by Randy Montoya)

(Continued on page 11)